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AUTHOR Yanosko, Barbara J.
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ABSTRACT

The five-week summer Upward Bound Program for high school students incorporated an individualized mathematics program during the summers of 1978 and 1979. Designed to be a remedial, developmental, or enrichment program, the courses utilized commercially available materials. Students were graded on the amount of work they completed. Improvements in basic mathematics and algebra were measured with standardized tests with about two-thirds of the students showing gains. The mean test score for the population also improved from pre- to post-tests. Attitudes were measured towards mathematics, mathematics classes, teachers, and mathematics ability and there was again improvement from the beginning of the summer to the end. It was concluded that the individualized model was successful for a short enrichment oriented mathematics class. (Author/MP)

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SUMMER MATH PROGRAM'S EFFECT ON STUDENT PERFORMANCE AND ATTITUDES

by Barbara J. Yanosko
Humboldt State University
Arcata, California 95521

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ABSTRACT: The five-week summer Upward Bound Program for high school students has incorporated an individualized mathematics program during the summers of 1978 and 1979. Designed to be a remedial, developmental, and/or enrichment program, the course utilizes commercially available materials. Students were graded on the amount of work they completed. Improvements in basic math and algebra were measured with standardized tests with about two-thirds of the students showing gains and the mean test score for the population also improving from pre to post tests. Attitudes were measured toward math, math classes, teachers, and math ability, and there was again improvement from the beginning of the summer to the end. Therefore, for a short enrichment oriented math class, the individualized model proves successful.

DISCUSSION. The Upward Bound Program at Humboldt State University is a program for economically and educationally disadvantaged high school students who show potential for post secondary education (one of the federally funded TRIO programs). During the summer the Upward Bound staff host a resident five-week intensive program in academic skill building as well as a wide range of leisure activities. For the summers of 1978 and 1979 an individualized math program was conducted based on the proposal given in Appendix A.

Although the concept was maintained and two of the staff persons worked both in 1978 and 1979, there were many differences so that the data

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obtained from the summer records are not strictly comparable. In testing, forms A and B of the McGraw-Hill Basic Skills Mathematics Test were used and only parts I and II were administered in 1978. In 1979 only form A was used and all three parts were administered. In 1978 the class met 3 days a week for a total of 13 meetings while in 1979, the class met 5 days a week (16 class meetings). In 1978 the attitude survey included 5 questions based on a 5 point rating scale but in 1979 four questions were asked on a 4 point scale. For these reasons data for each year will be analyzed separately.

1978. The basic unit of work in the individualized class was labeled a "task." At the beginning of the program each student was tested and assigned to material appropriate for his/her performance and experience level and was given a sheet outlining the minimum criteria necessary for successful completion of the math program: 25 tasks. The mean number of tasks completed was 28.9 for the 51 participants with complete data for the study. The students did, then, tend to do more than minimum work with the promise of higher grades as a reward. Actually, 45 of the 51 students met or exceeded the minimum. In 1978, 47 of the 61 (77%) students for whom scores were available improved percentile rank fro pre to post test.

The means for the other data gathered are given on page 3. The percentiles given for the testing means are the average of the norms given for Parts I and II for college-bound juniors and seniors in high school by CTB/McGraw-Hill. Percentiles are used since two different forms of the test were given, of slightly different difficulty levels. The percentiles

are comparable whereas the raw scores are not. The change in the means is statistically significant at the 0.05 level of confidence but not at the 0.01 level.

Activity	Pre	Post	Change	% of Change
Testing Means	15.3	17.1	+1.8	+12%
%-ile	10.5	18.0	+7.5	+71%
Attitude Q-1	3.608	3.627	+.019	+0.5%
Q-2	3.000	3.137	+.137	+4.6%
Q-3	3.216	3.275	+.059	+1.8%
Q-4	3.216	3.431	+.215	+6.7%
Q-5	3.373	3.333	-.040	-1.2%
Total	16.412	16.824	+.412	+2.5%

The statements in the attitude survey were:

Q-1 Math is interesting.

Q-2 I am good in math.

Q-3 I like my math classes in school.

Q-4 I would like to take more math.

Q-5 I like math.

The scale used was: 5 = strongly agree; 4 = agree; 3 = neutral; 2 = disagree; 1 = strongly disagree. Although none of the attitude shifts were statistically significant it is interesting to note that the greatest attitude gains are in terms of self concept (Q-2) and a positive attitude toward continuing studies in mathematics.

A comparison of variables was run using SPSS7 online on the Central Timesharing System of the CSUCS system in California (see scattergram printouts).

A. Pre-test percentile against the number of tasks completed to determine if the more advanced students completed more work of visa versa. The results indicate that there was no significant correlation suggesting students were challenged at every level.

B. Next the pre-test percentile was compared to the change in percentile rank to see if those further behind would make greater gains; again no correlation.

C. Pre-test Percentile compared to attitude change showed no correlation.

D. Change in percentile compared to change in attitude showed a slight correlation but not of any statistical significance.

E. The number of tasks completed compared to the change in attitude showed the greatest relationship although not in terms of statistical significance. The slope of the linear fit curve is .68322, significance .02176 which tends to support the notion that the more tasks completed, the greater the attitude change or visa versa, but does not indicate the strongest relation.

F. Finally, the change in percentile rank was measured against the number of tasks completed again without correlation.

Whatever happened during the summer program of 1978, test scores did improve; students did the work expected of them and attitudes toward math improved slightly. In terms of the program administrators the math class

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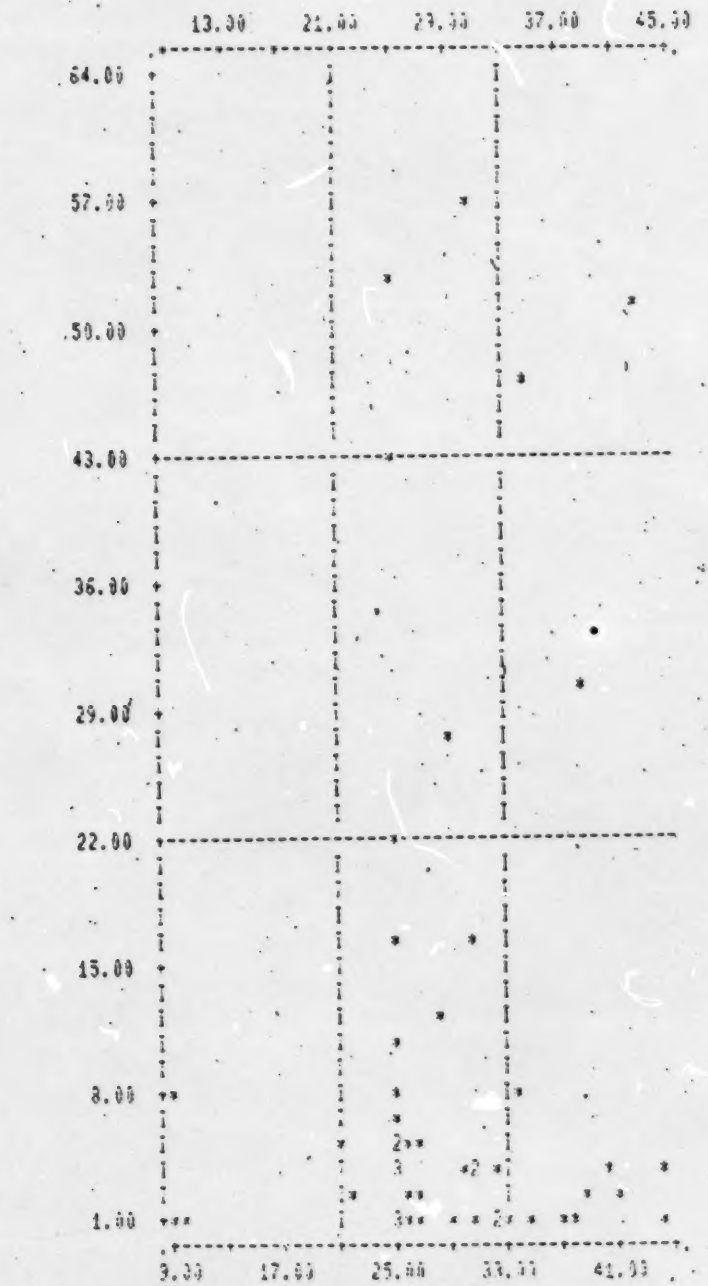
GIVEN 2 VARIABLES. [illegible] FOR 4451 CASES.

PLOT OF PRE-MILE
(ACROSS) TASKS



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[illegible] - 3.14455 STD ERROR OF A - 8.21333
[illegible] - .35188 B.VAR (R) - .25230
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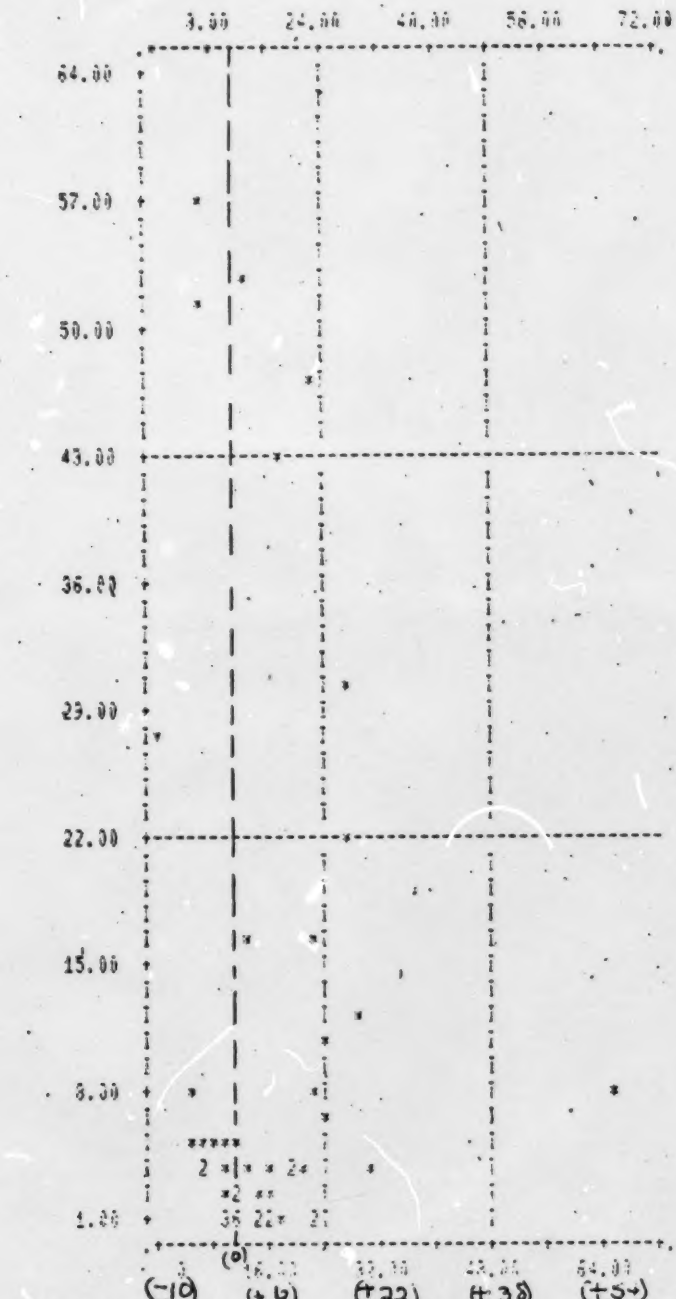
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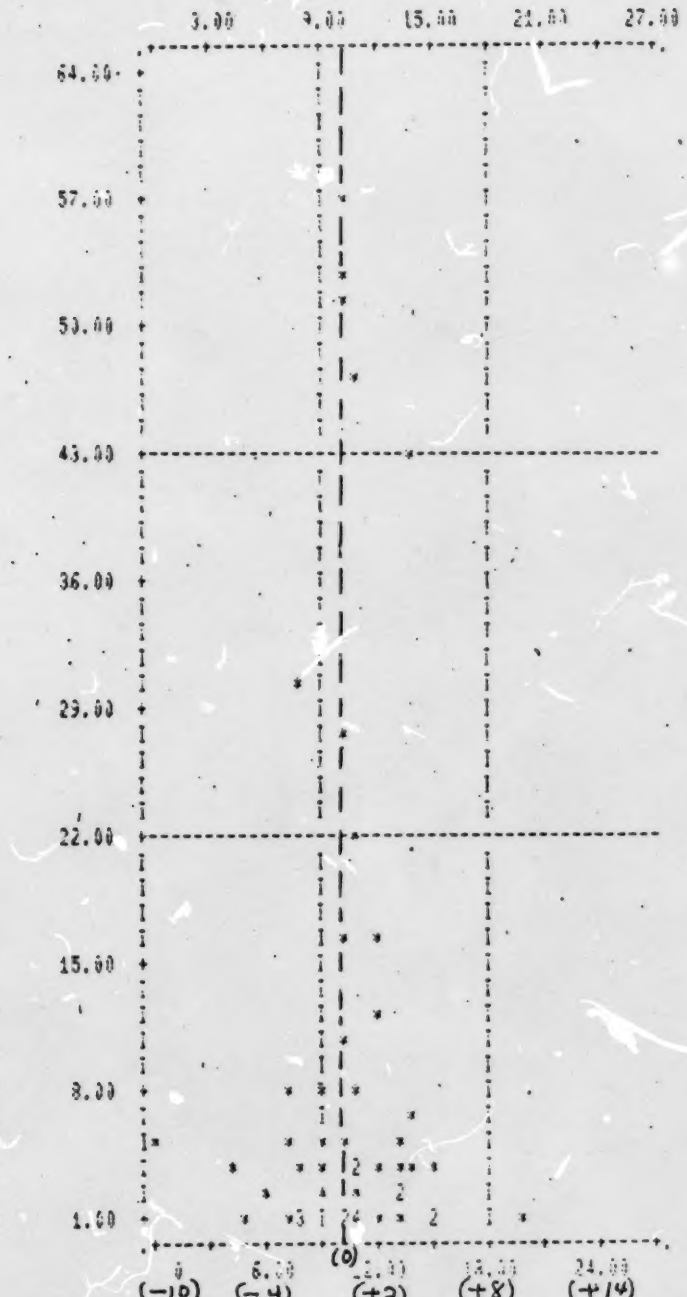
(ASTERISK) YHAT



CORRELATION (R)	-	.99212	R SQUARED	- .98430
SIGNIFICANCE R	-	.0041	STD ERR OF EST	- 15.18+1.
INTERCEPT (A)	-	14.34762	STD ERROR OF A	- 7.27343
SIGNIFICANCE A	-	.08969	SLOPE (B)	- .10931
STD ERROR OF B	-	.55718	SIGNIFICANCE B	- .0041

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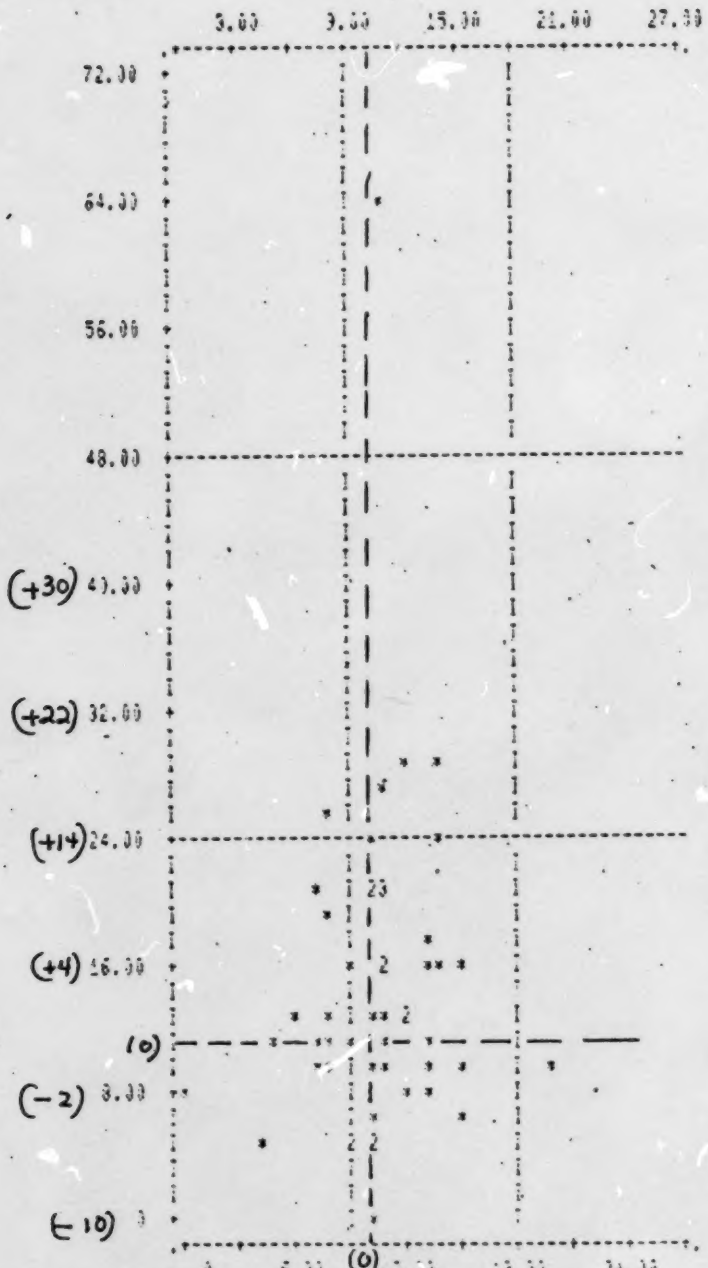
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9

- - - SCATTERPLOT - - - E

SUMEN 2 OBSERVATIONS READ FROM A..DAT FOR 4491 CASES.

(3349) TASKS
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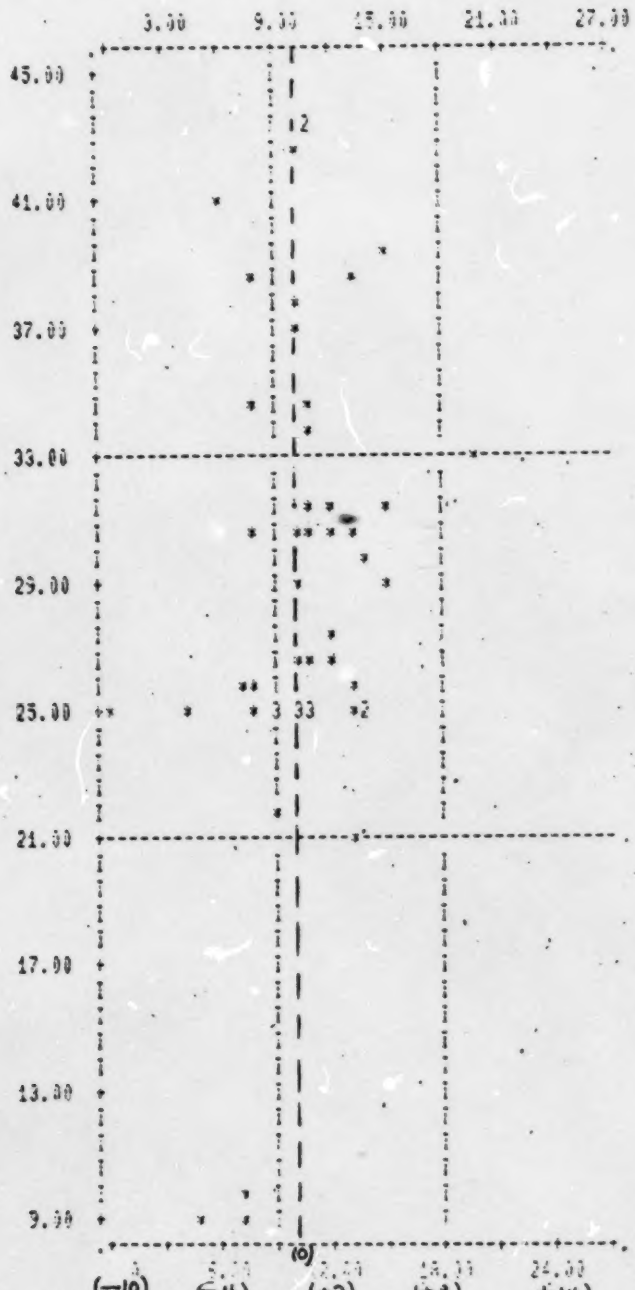

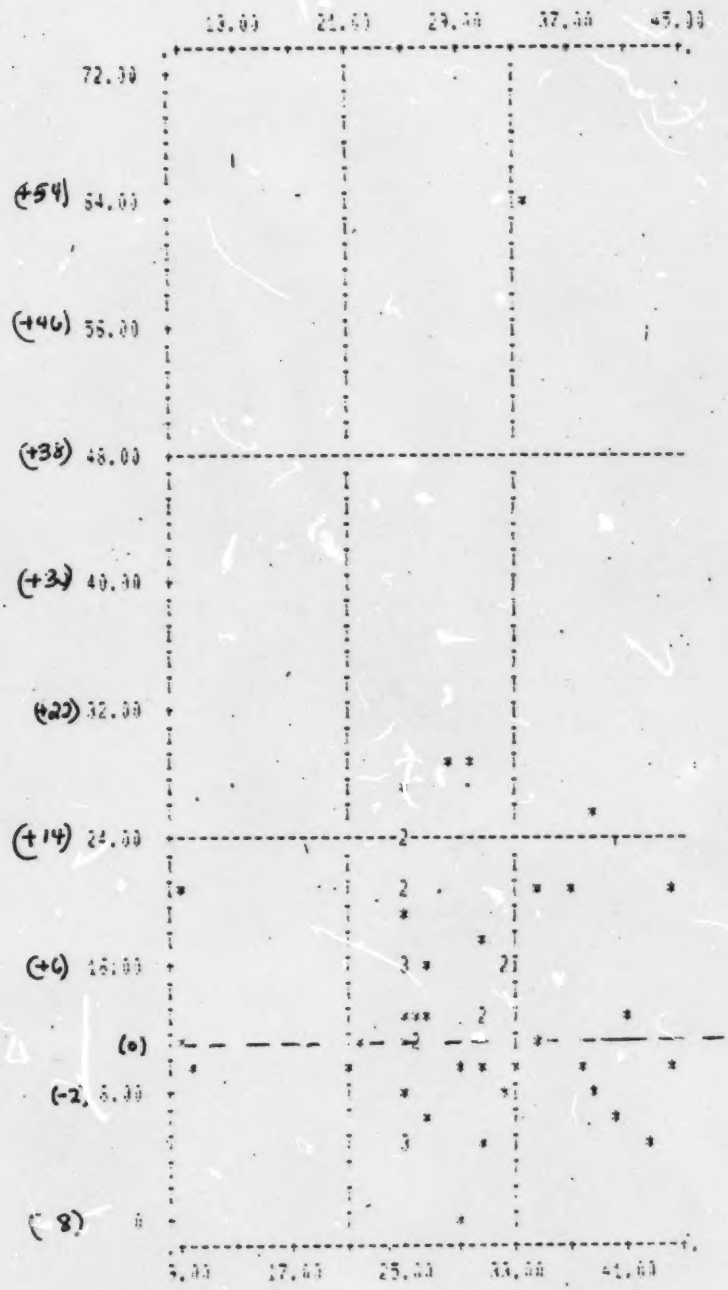
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was a success; enough of a success to invite the program to be run again the next summer.

1979. As in the previous year the basic unit of work was a "task." The minimum number of tasks this year was 32. Students completed an average of 32.6 tasks with 23 out of 53 students included in this study (43.4%) not meeting the basic requirement. In actuality only 6 students did not receive credit in the course. During the five-week period students were introduced to games on the computer through the use of interactive terminals (1 day) and a mini-computer brought into the classroom (2 days). Of the 60 students who were pre and post tested, 41 (68%) improved their scores. The means for the other data are given below.

Activity	Pre	Post	Change	% of Change
Testing				
Mean P-I	9.245	10.321	+1.076	+11.6%
P-II	6.075	7.151	+1.076	+17.7%
P-III	4.623	5.604	+0.981	+21.2%
Total	19.774	23.075	+3.301	+16.7%
Percentile				
P-I	6%-ile	9%-ile	+3	+50%
P-II	5%-ile	8%-ile	+3	+60%
P-III	9%-ile	14%-ile	+5	+56%
Total	5%ile	9%-ile	+4	+80%

The change in the test score means is statistically significant at the .05 level of confidence.

Activity	Pre	Post	Change	% of Change	L.C.
Attitude					
Q-1	2.453	2.868	+.415	+16.9%	(.01)
Q-2	2.481	2.774	+.293	+11.8%	(.05)
Q-3	2.849	3.311	+.462	+16.2%	(.01)
Q-4	2.215	2.481	+.266	+12.0%	(.05)
Total	9.998	11.434	+1.436	+14.4%	

L.C. indicates level of confidence.

The statements in the 1979 survey were:

Q-1 I like math.

Q-2 My math classes are interesting.

Q-3 My math teachers are good.

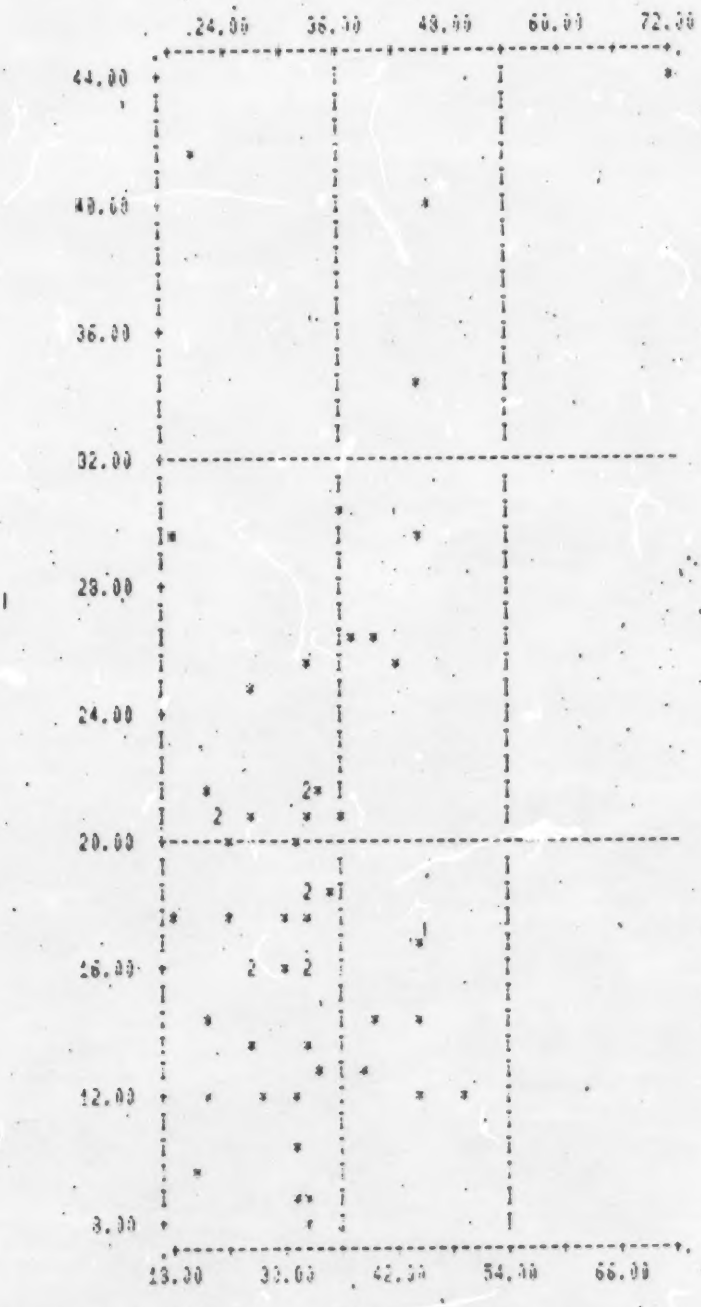
Q-4 I am good in math.

The statements were rated on a 4 point scale were 4 = strongly agree; 3 = agree; 2 = disagree; and 1 = strongly disagree. All the attitudes improved significantly where the levels of confidence are given in the table. This year the strongest gains were in liking math and math teachers.

Again comparisons were run among variable in the learning situations:

I. The total pre-test score was compared with the number of tasks completed showing a weak positive correlation. This year the better a student tested initially, the more likely he/she was to complete more tasks.

II. The total pre-test score was compared to improvement in attitude with little correlation. Therefore, the level at which students first tested was not a predictor of a positive change in attitude.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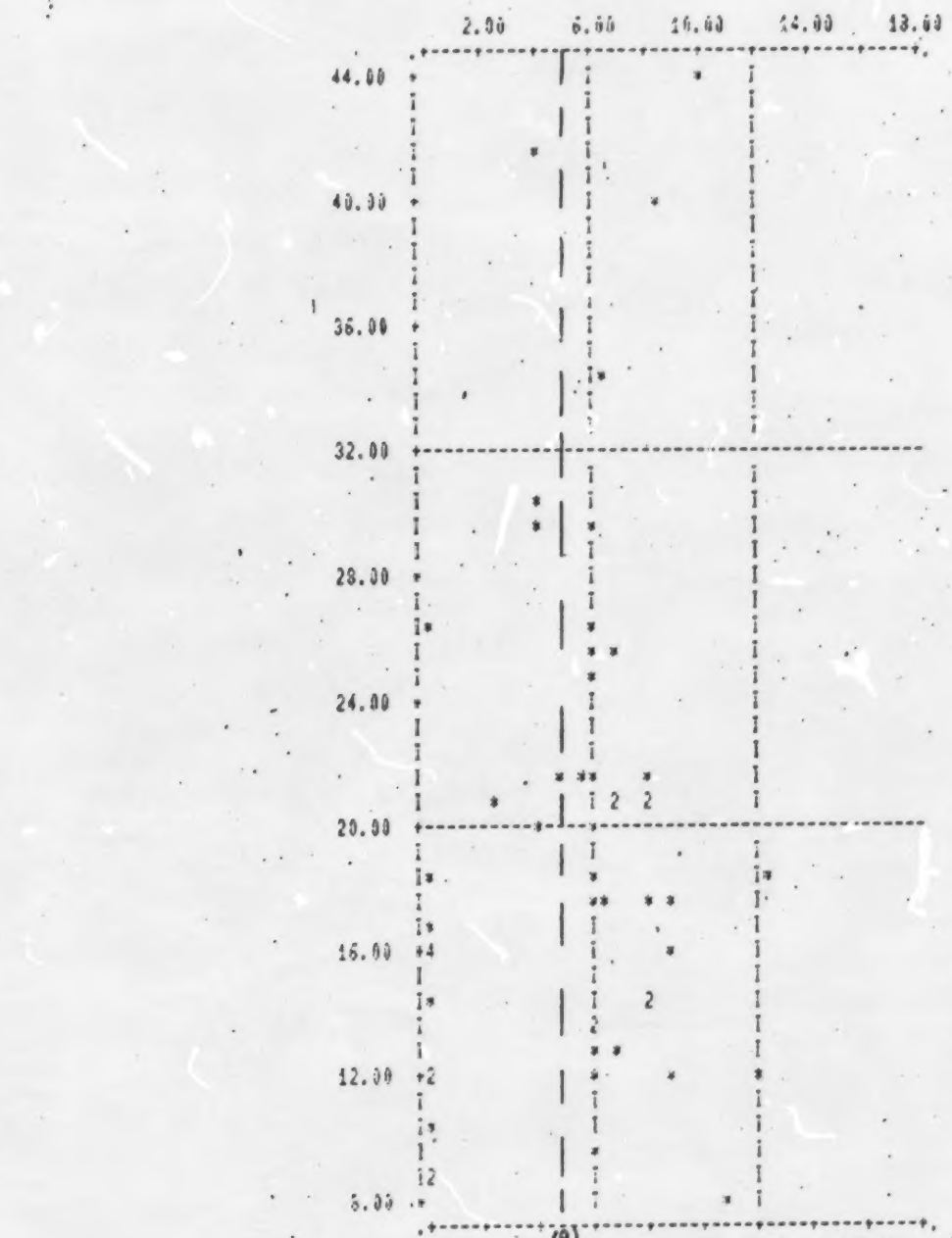
- - - SCATTERGRAM - - -

GIVEN 2 VARIABLES, ARRAYED ON 5 LEVELS FOR 4449 CASES.

(COLUMN) TR PRE-TATR
(ACROSS) AINP ATTITUDE IMPROVE



CORRELATION (R)-	.17943	R SQUARED -	.03219
SIGNIFICANCE R -	.00000	STD ERR OF EST -	8.10135
INTERCEPT (A) -	17.53814	STD ERROR OF A -	2.00254
SIGNIFICANCE A -	.00000	SLOPE (B) -	.41624
STD ERROR OF B -	.04855	SIGNIFICANCE B -	.00000

PLOTTED VALUES - 53
EXCLUDED VALUES- 0
MISSING VALUES - 0
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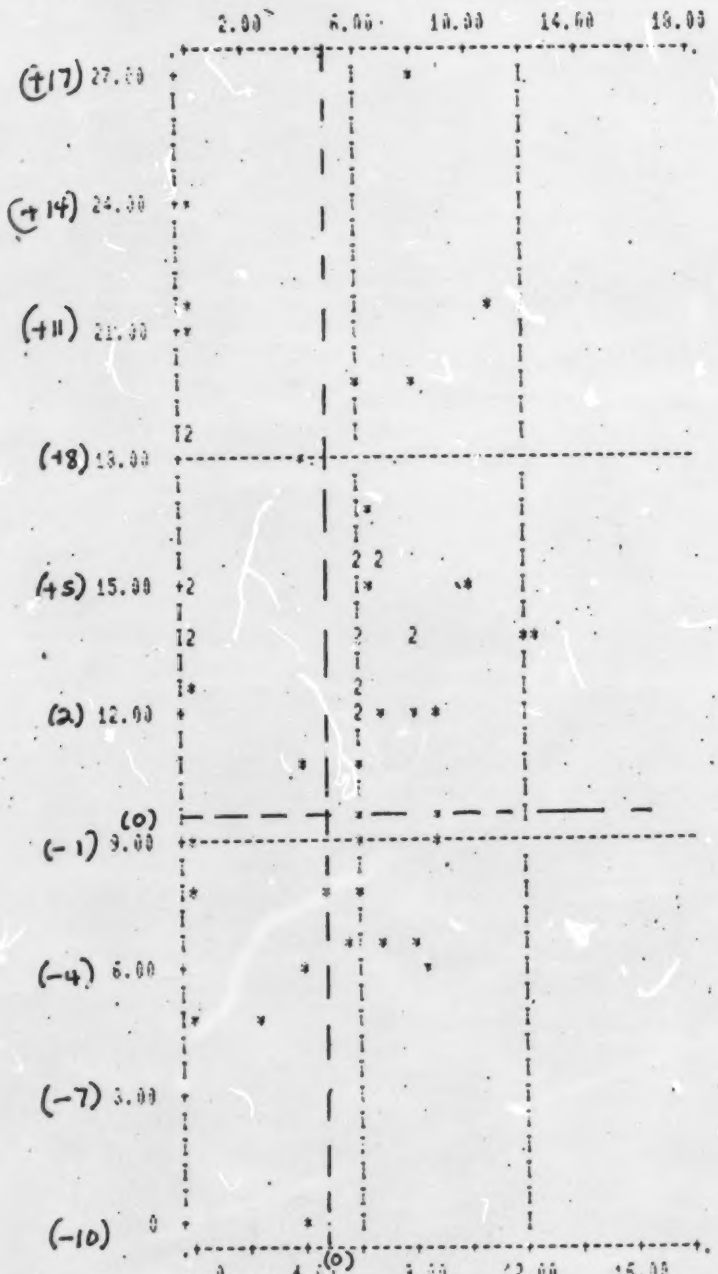
- - - SCATTERGRAM - - -

III

GIVEN 2 VARIABLES, RANGING ON A LOAD FOR 4449 CASES.

(JOBAV) TITLE TOTAL IMP
(AC0955) MINP ATTITUDE IMPROVE



CORRELATION (R)-	.03847	R SQUARED -	.00148
SIGNIFICANCE R -	.39225	STD ERR OF EST -	5.56244
INTERCEPT (A) -	13.51049	STD ERROR OF A -	1.32552
SIGNIFICANCE A -	.00001	SLOPE (B) -	-.65796
STD ERROR OF B -	.21085	SIGNIFICANCE B -	.39225

PLOTTED VALUES - 53
EXCLUDED VALUES- 0
MISSING VALUES - 0
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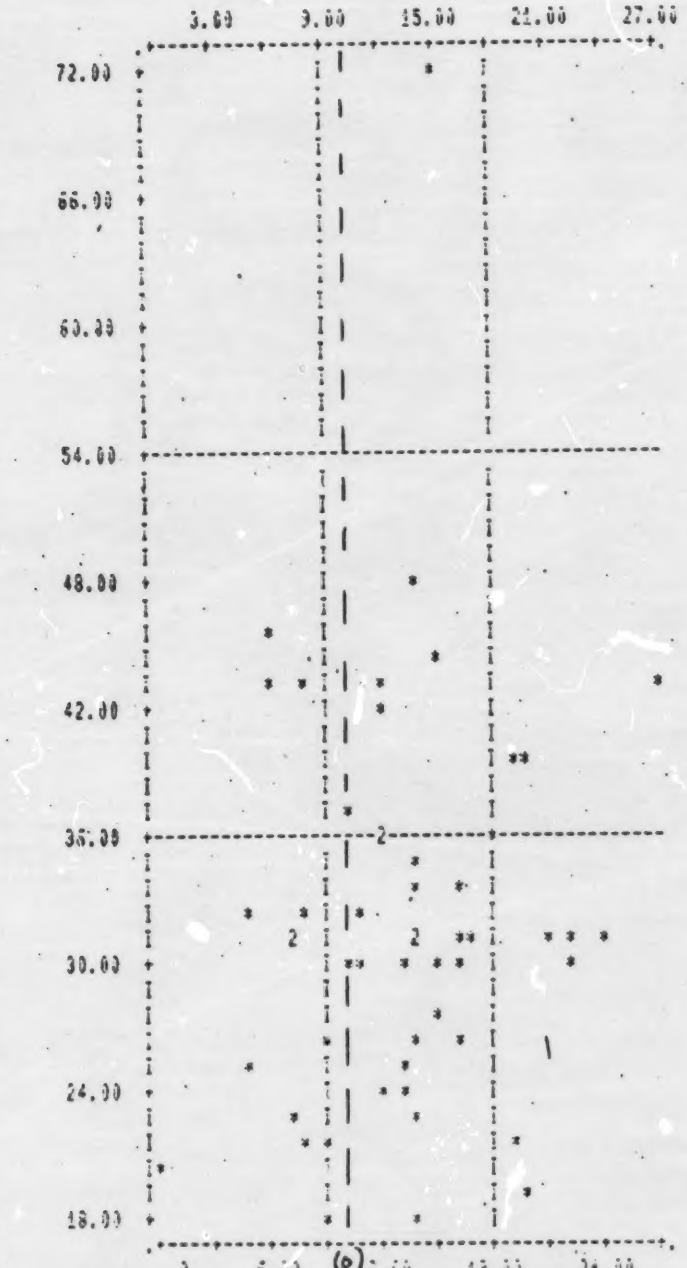
- - - SCATTERGRAM - - -

GIVEN 2 VARIABLES (TOTAL) ON ALL 48 FOR 4449 CASES.

(0040) TA545
(AIR053) TIMP TOTAL IMP



CORRELATION (R) -	.12741	R SQUARED -	.01623
SIGNIFICANCE R -	.18239	STD ERR OF EST -	9.33199
INTERCEPT (A) -	29.86273	STD ERROR OF A -	3.48439
SIGNIFICANCE A -	.00001	SLOPE (B) -	.22411
STD ERROR OF B -	.24907	SIGNIFICANCE B -	.18239

PLOTTED VALUES - 53
EXCLUDED VALUES- 0
MISSING VALUES - 1
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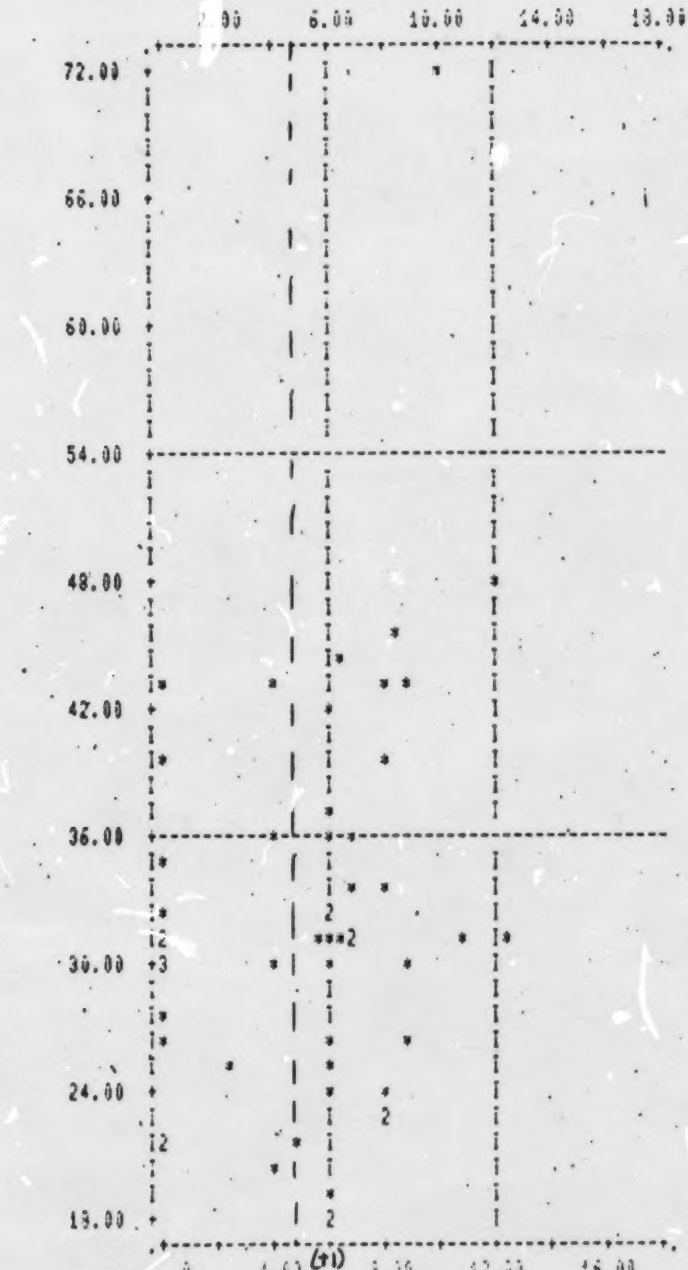
GIVEN 2 VARIABLES, MAXIMUM OF MISSING FOR 4443 CASES.

(DOWN) TARGS
(ACROSS) AIMP ,ATTITUDES IMPROVE



CORRELATION (R) -	.24366	R SQUARED -	.05937
SIGNIFICANCE R -	.03594	STD ERR OF EST -	3.18338
INTERCEPT (A) -	29.21663	STD ERROR OF A -	2.26938
SIGNIFICANCE A -	.00001	SLOPE (B) -	.64787
STD ERROR OF B -	.36139	SIGNIFICANCE B -	.03336

PLOTTED VALUES - 53
EXCLUDED VALUES- 0
MISSING VALUES - 0
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III. Improvement in test performance was compared to improvement in attitude with no correlation and even a slight negative trend.

IV. The number of tasks completed was then compared to the improvement in test score and there was a slight positive correlation but nothing of any statistical significance.

V. Finally the number of tasks completed was compared to a change in attitude again with a weak correlation. The question is whether a more positive attitude means the student works harder or visa versa. It would seem the former is more likely.

CONCLUSION: Based on the available data it is clear that the program improves performance on standardized tests and improves attitudes towards math in general and builds belief in one's ability to do math. The students who worked three days a week showed greater improvement than those who worked five days a week but started with higher measured achievement. Although the mean number of tasks completed for each group was not vastly different, differences in schedules (number of days spent in testing, days off, excused absences, the number of pages to be completed for a task) evened out so that 2.15 tasks per student per day were completed in 1978 and 2.03 were completed in 1979.

Attutudes improved most in the second year of the program. This may be due to a number of factors: about a fourth of the students were back from the previous year and were accustomed to the procedure; the novelty of the computer games was an incentive to think of math as "fun"; the student/teacher(aide) ratio dropped from 10 to 1 to 8 to 1 so that all paper grading could take place in class whereas the previous year sometimes

students would have to wait until the next day; for advanced students the SRA Algebra Kit was available in 1979 but not in 1978; it was noted that the students in the 1979 U.B. group generally had a better attitude. The strongest correlation established was between attitude change and the number of tasks completed for both years in a direct proportion. Again it is probable that the students with the more positive increases were more likely to complete more work.

Between the two years, the second year was more effective in terms of attitude change. The number of tasks per day and the increases in test scores held relatively steady. Above all, the individualized model is shown to be successful in improving test performance and attitudes toward math in high school students during a five-week summer program.

REFERENCES:

McGraw-Hill Basic Skills System, Mathematics Test, Forms A & B and Examiner's Manual, McGraw-Hill Book Company, Monterey, California, 1970.

Nie et. al., Statistical Package for the Social Sciences, Second Edition, McGraw-Hill, Inc., New York, New York, 1975.

P. Rasmussen, Key to Algebra, Booklets 1-4, Key Curriculum Project, Berkeley, California, 1972.

SRA Kits, Algebra, Science Research Associates, Chicago, Illinois.

Vannatta and Stockinger, Basic Mathematics, Kit C, Charles E. Merrill Publishing Co., Columbus, Ohio, 1974.

APPENDIX A

Upward Bound 1978
Summer Math Program Proposal

Presented by Barbara J. Yanosko
Humboldt State University

Goals: To diagnose and alleviate weaknesses in basic mathematics and provide enrichment materials by approaching each student as an individual.

Objectives: A. To improve student performance on a standardized test by at least 10%.

B. To improve student attitudes toward mathematics.

Personnel: One instructor and an assistant.

Timetable: One hour per day, five days a week for the five weeks of the summer session.

Materials:

I.	20 copies	McGraw-Hill Basic Skills Mathematics Test, Form A; McGraw-Hill Publishing Co.
II.	1 Kit	Basic Mathematics, Kit C., G. D. Vannatta and J. Stoeckinger, Charles E. Merrill Publishing Co., Columbus, Ohio, 1974.
	50 copies each	Key to Algebra, Rasmussen, Key Curriculum Project, Berkeley, CA, 1972, Booklets 1-4
	3 copies	Pre-Calculus Mathematics, Trigonometry, V. E. Howes, John Wiley & Sons, Inc., New York, N.Y., 1967.
	1 Kit	SRA Algebra Skills Kit, Science Research Associates
III.	15	Manilla Folders (for student records and to hold Merrill materials)
	1	File box or cabinet to hold student folders and math materials
	4 reams	Ditto paper

Method: Each student will take the McGraw-Hill Math Test and the Class and Attitude Survey to place them in an individualized program. Students without experience in algebra will begin with the Merrill Skill Kit C and follow the program outlines in the Kit. Students who have completed Algebra I or the Skills Kit will begin with Book 1 of the Key series and aim to complete at least 4 pages per day in the workbooks. Students assigned to the Key series will be given a book in which to work. Students without experience in Geometry will be asked to complete the Geometry section in the Merrill Kit. Students completing Algebra II or the Key series will work in the Pre Calculus Mathematics series - 1978 (SRA Algebra Kit - 1979).

Each student will maintain a folder in which will be filed all completed and in-process worksheets and workbooks as well as a record of his/her progress in the program. A student coming into the class would first pull his folder and then with the assistance of the instructor, if necessary, obtain the materials necessary for the day's work. A minimum would be required for each day such as 2 worksheets or 4 pages in a workbook. A maximum of 4 errors will be accepted for student to progress to the next task. Otherwise, the instructor should help the student understand the material and correct his errors.

The responsibility of the instructor and his/her assistants include: administering and scoring pre and post tests and questionnaires, determining entry level, assigning materials, grading materials, and returning them to the students, answering questions, assisting students having difficulty, maintaining student records and keeping materials

accessible. Ideally materials will be scored and returned within the class period. If this is not possible, papers will be scored for return the next class day. Rapid scoring is essential so that the student can easily continue his sequential program.

Since each student's program is individual, all levels can work simultaneously in the same classroom.

Evaluation: Progress will be determined by comparison of pre-and post-McGraw-Hill test results. Attitude change will be measured by a short pre- and post-attitude survey. Student attitudes toward the program will be measured in part by the amount of work completed during the allotted time.